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Perhaps it would be helpful to the new astronomy PhDs if this kind of list were prepared for all areas of the United States. They should know where to find many of their predecessors.

G. STANLEY BROWN
JAYCOR

8/81

Alexandria, Virginia

Predicting the future

A few comments on the November 50th Anniversary Issue, particularly Norman Ramsey's article, "Physics in 1981 $\pm$ 50" (page 26).

► One quite safe prediction that Ramsey missed could have been based on the cover page, which showed photographs of the 1931-1981 Nobel Prize winners in physics. It appears quite clear that a sure way to avoid the Nobel Prize would be to sport a beard.

► I am reminded of the 50th Anniversary Issue (May 1962) of the Proceedings of the Institute of Radio Engineers, which contained 918 pages of advertisement-free text. Under the heading, "Communications and Electronics—2012 A.D.," 55 outstanding Fellows of the Institute presented, in 94 pages, their views regarding future progress in eight broad categories. With 40% of the 50 years now behind, I recommend that future predictors review the scores of the IRE predictors. As expected, many of the most imaginative predictions have yet to be realized. On the other hand, it is significant that experts in their own fields did not anticipate wideband communication utilizing fiber optics (gas-filled pipes were discussed), nor was there any indication that the present fantastic density of very large scale integrated circuits would be realized so soon. One favorite prediction of the period, that of the television "picture on the wall," was made and claimed to be just around the corner—where it still is.

► A thoughtful comment on the art of prediction is the first paragraph of C. G. Suit's paper, "The Potential of Progress: An Optimistic View":

However diverting it may be to gaze into crystal balls it is well to

realize that they are essentially mirrors, for they reflect only the philosophy of history that the viewer happens to embrace at the moment. Predictions tend to be projections of trends or, if not trends, experiences; and trends themselves are quite relative, based as they are upon individual interpretation of past and present events. It has been said that there is no history, there are only historians. So also, in this sense, there is no future, except in the minds and abilities of creative and perceptive people, who will give substance and form to the future patterns of nature.

In reviewing the anniversary issue of the IRE Proceedings, I found that most predictions were, indeed, rather ordinary extrapolations of the then-present art.

► The section in PHYSICS TODAY, "Looking back on books and other guides," was very interesting. One significant point of interest to me is that three contributors (Pauling, Hofstadter and Townes) spoke favorably of the influence of Ed Condon. Condon was my boss for the few years he was director of research at Corning Glass Works. The power of his intellect and personality was impressive. I was 50-ish at the time, perhaps too late for a change. However, to this day the younger men here still speak of his influence. Frequently I have pondered on the course Condon's career would have taken had he not turned to industry (Westinghouse, National Bureau of Standards, and Corning Glass). I am convinced that had he stayed in the academic world his picture would have been among the other Nobel Prize winners on the front page.

After leaving Corning, he continued as a consultant until his death and visited here regularly for many years. During this period I lunched with him many times and I recall with pleasure the stimulating discussions on many subjects. The enthusiasm and spirit of the man was tremendous.

JOHN L. SHELDON
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12/81

Physicists are "frustrated"

The objectivity of science and especially of physics is reflected in its formalized language. Subjectivity is suppressed to such a degree that the attribution of a physicist's name to a formula is a subtle way of taking out its personality.

Some exceptions exist with the use of words like "color" and "charm"—referring, however, to objects or qualities as seen from the outside. Recently a ser-

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letters

ious breakthrough occurred with the introduction and large spread of the word "frustration" to describe the state of a physical system (the following expressions have been used: frustrated spin, frustrated lattice, frustrated bond, frustrated electron, quantum frustration, frustrated spin-glass... and even super-frustrated spin). This word is normally used outside physics to describe the internal psychological situation of an individual (or of a group of individuals).

The written concept of frustration has first appeared in publications in relation with the study of disordered magnetic compounds called "spin glasses." It has been also applied to nonrandom systems where the interacting physical units do not build a simple organized structure. This is the case, for example, for a set of spins ± 1 on a triangular lattice interacting through an antiferromagnetic exchange interaction. The spins do not order in a simple way; the ground state is degenerate and the spins are said to be frustrated.

Physical objects such as magnetic moments are neutral objects without any feeling and internal contradictions: How can they be frustrated? Paradoxically it is when the physicist's community is confronted with the development of para-sciences (which want to attribute, among other things, a "spirit" to the electron) that it adopts the notion that a spin can be "frustrated." This notion of "frustrated" spin being able to lead non-scientific people to understand that the spin possesses an internal psychology.

Such a subjective language can certainly only reflect the situation of physicists. Within a period of a few months of latency after the first use of the word frustration in 1977, a resonance phenomenon appears in the statistical mechanics and solid-state communities. Everyone talks about frustration and papers appear with the word frustration used first in the title and then in the text. Each one wants to cry his frustration by using this word at least once (some do it early, others—more shy—later, when the movement is already set in). This word is mainly used in condensed-matter physics, spreading from magnetism to electronic systems and even to liquid crystals; it has also attracted some high-energy physicists. The word is often used when it does not bring any new information and can most often be explained by adding to it a neutral word like blocking or competition.

The reaction of the community of physicists to the concept of frustration reflects its actual psychology. Subjectivity has always influenced the scientific

fic work but in a very indirect way. The choice of such a subjective concept is certainly not fortuitous. Physicists are facing today contradictions which are the origin of the frustration they project in their scientific writing. They want to invest in physics and they are disturbed by the increasing pressure of social and economical problems.

The concept of frustration is now also used by experimentalists who will measure it in the near future! The use of the word frustration should reach a peak and then decrease, reflecting the fact that after expressing their problems, the physicists are ready to face and solve them: Frustration would be transformed into liberation and the "frustrated" spin would become a "liberated" spin.

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10/81

Japanese mode of thinking

As an inventor living in Japan for the past 11 years, I found Makoto Kikuchi's article "Creativity and Ways of Thinking: the Japanese style" (September, page 42) refreshing; he explained the way Japanese think in a very straightforward "Western" mode that was clear and to the point. The feel of the article, however, was very Japanese, and I would like to add a few words from quite a different perspective, necessarily a personal view.

In itself a "personal perspective" does not exist for the Japanese. Dull conformity is the rule, and mothers warn their children from an early age not to be different from others, that the nail which sticks out is sure to be hammered down! Conformity as such need not be dull, and the Japanese are sensitive enough to subtle changes in situations and make delicate creative steps in many aspects of their social, research, manufacturing and other activities. It is the collective inability of the system to make quantum jumps in creativity that I find so dull and frustrating, especially when I try to introduce my inventions to Japanese companies. The basic ideas are very quickly grasped by a large group of technicians, each one studying the matter from a different angle. It is when the group has to make a decision to do something new that a general timidity is perceived, and on some occasions I was told "this idea will work in the States only." The Japanese group is a very compact matrix in which every element has a special place and function. A new idea must be very carefully screened, because it might disrupt the

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